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The verbal behavior of three children was sampled. The samples were analyzed to obtain a picture of three stages of the children's language development, specifically the interrogative structures. Each stage was about 4- or 5-months long, starting at the 18th to 28th month, depending upon the child's level of linguistic ability. The interrogative structures of primary interest were (1) intonation patterns, (2) auxiliary inversion, (3) negation, (4) WH word (what, who, why, etc.) placement, and (5) tag questions. At stage one, inflections, auxiliaries, articles, and most pronouns were absent. The child used intonation to mark a question. There were no yes-or-no questions and only a few WH questions. There were no tag questions. The child at this stage did not appear to understand the interrogatory structure when he heard it. At stage two, articles, pronouns, and negative preverb forms appeared. Auxiliaries were still not present, nor were tag questions. Stage three included the emergence of the use of auxiliaries, auxiliary inversion, and the do transformation. Inversion and transformation were found in yes-or-no questions but were absent in WH questions. Tag questions were still absent, but the children understood and responded well to questions. An appendix of sample questions obtained from the subjects at each stage is included. (WD)

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The Development of Interrogative Structures in Children's Speech

Ursula Bellugi

"The more we learn about language,
the harder language learning looks."

Jerry A. Fodor:
How to Learn to Talk; Some Simple Ways.

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Until recently, psychologists ignored the problem of development of language in children except to count parts of speech as if they were the same as categories in adult speech and the like. Then the development of American structural linguistics as a discipline parallel to American behaviorism began a new interest in language acquisition. Some research centers were stimulated to begin studies of child language, in much the same way as anthropological linguists studied foreign tongues in the field. Psychologists began looking at child language as if it were an exotic unknown language to be described by techniques which had been developed by structural linguists. In the midst of this new confrontation of psychology and linguistics, the transformational generative theory of grammar arose to suggest dramatic and basic changes in the entire concept of linguistics, the theory of language, and the capacity for language acquisition.

This theory of language holds serious promise for an understanding of the structure of language, the relations between sentences, and an elucidation of the creative aspects of language; that is, the fact of novelty of utterances. And it entailed a serious recasting of some basic notions in psychology, at least to the extent that it is now clear that psychological theory was inadequate to account for language acquisition.

Transformational grammar, then, gives us a powerful tool in working out the structure of language and in considering afresh the problem of language acquisition. My approach in studying the development of interrogative and negative structures in children's language has been to work through serious formulations of those portions of English grammar by classical grammarians and by transformational grammarians.

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A very thorough and insightful classical work has been written by the Danish linguist, Otto Jespersen, on Negation in English (1917), and a very elegant exposition of negatives in terms of transformational theory is presented by Edward Klima in an article which appears in Fodor and Katz, The Structure of Language (1964). We do not yet have the equivalent work in interrogative structures, although there are a number of partial and preliminary formulations. Chomsky (1962), Katz and Postal (1964), Lees (1960), and Klima (personal communication) all have devoted some attention to interrogatives, but all of these leave many questions about questions unresolved. However, they point in interesting and provocative directions in the analysis of questions in English.

Interrogatives in English

The result of these investigations show several facts of importance. I'd like to ask that we consider sentences as strings of symbols (you might try replacing the words with X - Y - Z) upon which certain operations can be performed. For example, you can permute or change around two of the terms in the string to get Y - X - Z. The resulting string, after rearrangement, will be related in ways we can define to the original string. In order to make this easier, we can use jabberwocky or nonsense instead of words, and try to get at what makes a string of symbols felt to be a question.

Suppose you have the sentence

THE MOG WIBBLED THE GOMP.

Notice first that you can be quite sure of the elements in the sentence, even though the main words are nonsense. THE MOG is obviously the subject of the sentence, WIBBLED is a transitive verb in the past tense, and THE GOMP is the object. I'd like to ask you to make up some questions using the information from that sentence; that is, transform it into several different questions. We would find a range of results like the following:

DID THE MOG WIBBLE THE GOMP?
WHY DID THE MOG WIBBLE THE GOMP?
CAN THE MOG WIBBLE THE GOMP?
WHAT WIBBLED THE GOMP?
WHAT DID THE MOG WIBBLE?
etc.

I don't think that you would have any difficulty in constructing questions like these from source sentence. An analysis of the operations that are involved in transforming the original sentence to any of these questions is exactly the point of the first part of this paper.

Notice that there are other variations which seem to have a question aspect:

THE MOG WIBBLED WHAT?
THE MOG WIBBLED THE GOMP?
THE MOG CAN WIBBLE THE GOMP, CAN'T HE?

but not:

WHAT THE MOG WIBBLED WAS GOMP.

Notice that the last sentence has some of the characteristics of questions: an interrogativ word WHAT is at the beginning of the utterance; the intonation pattern is the same as a WHAT question; but it is not regarded as a question. This is another fact about patterns of the language which our analysis must take into account.

To lead those of you who have had no contact with linguistic analysis down these pathways may be indeed like wandering in an underground labyrinth, or worse yet, some level of detail that is irrelevant to language functions as you have so far considered them. But I would like to suggest that you follow the first part of this discussion by leaving aside your notions of grammar from grammar school, your involvement and facility with language, and moving back one step. Consider a sentence of a language as a set of symbols arranged in a string with a certain definable structure, and consider that operation can be performed on these strings that transform them to other related structures; for example, active to passive, affirmative to negative, declarative to interrogative.

These operations are entirely within the capacity of any speaker of a language and are capacities which are acquired by children in their acquisition of syntax, and therefore are germane to our consideration of the development of language functions. It is really only when we begin to look at <u>what</u> is learned in some depth that we can begin to ask about <u>how</u> language is learned.

If we take a simple sentence and some questions formed from it, we can examine in some detail what happens to change one into the others. Take a sentence like the following:

CHAGALL MADE STAINED GLASS WINDOWS FOR THE CITY OF JERUSALEM.

We want to analyze several questions which can be constructed from the above string of words.

DID CHAGALL MAKE STAINED GLASS WINDOWS FOR THE CITY OF JERUSALEM?
DIDN'T CHAGALL MAKE STAINED GLASS WINDOWS FOR THE CITY OF JERUSALEM?
WHAT DID CHAGALL MAKE FOR THE CITY OF JERUSALEM?
WHO MADE STAINED GLASS WINDOWS FOR THE CITY OF JERUSALEM?
CHAGALL MADE STAINED GLASS WINDOWS FOR THE CITY OF JERUSALEM, DIDN'T HE?

A. Intonation Contour

Some of the above questions have intonation patterns that are different from the rest, namely, the ones which do not have an interrogative wh word. These are generally called yes/no questions because they can be answered by yes or no only, while the wh word questions require a different kind of response.

Try replacing the syllables of the string with da and listen for the changes in pitch level.

A declarative:

CHAGALL MADE STAINED GLASS WINDOWS FOR THE CITY OF JERUSALEM.

Da-da da da da da-da da da da-da da da-da-da-da.

This is usually described by linguists as a 2-3-1 pitch contour, and the point here is that the pitch goes down at the end of the sentence.

A wh word interrogative:

WHAT DID CHAGALL MAKE FOR THE CITY OF JERUSALEM?

Da da da-da da da da da-da da da-da-da-da?

While the pitch level change is not the same as the declarative intonation, again the pitch level goes down at the end and fades.

A yes/no interrogative:

DID CHAGALL MAKE STAINED GLASS WINDOWS FOR THE CITY OF JERUSALEM?

Da da-da da da da da-da da da da-da da da-da-da-da?

In this case, the pitch level goes up and stays up, ending on a higher level than the one on which the sentence started.

One operation involved in the construction of yes/no questions, then, is a change in intonation contour so that the pitch level rises and stays high. This is generally denoted as 2-3-3 and is a signal for questions. Notice that this is one way of converting a sentence to a question without performing any other operations.

Contrast:

The boy played with his dog?
The boy played with his dog.

The rising pitch level also applies to the tag question, can he? or didn't she?

B. Auxiliary Inversion and Negation

Examining again the declarative sentence and the questions formed from it, we can begin to look at the auxiliary verb in each case.

In the declarative sentence, there is a main verb which is in the past tense (Make + past tense = made) and no auxiliary verb. In all but the wh-subject question, there is an auxiliary verb, which is a form of do. Looking more closely, we notice that it is the past tense form of do and that the main verb has lost the past tense marking. We can consider that the past tense marker has moved from the main verb and been incorporated into the auxiliary verb.

Looking at a sentence which already has a modal auxiliary, we can begin then to see the function of the do auxiliary in the above set of materials.

I can go out.
Can I go out?
Where can I go?

Notice that the auxiliary of the verb has switched places with the nounphrase in both forms of question. It looks like, in order to construct most questions, the nounphrase and the auxiliary verb of a sentence have to be interchanged. That this is an intrinsic part of questioning in English is suggested by the fact that this word order sounds like a question even without the rising intonation and without a wh word. Can I go out, while not strictly a question, seems to suggest interrogation. So we have a second operation which defines questions in English, and that is that the auxiliary verb moves before the nounphrase of a sentence under interrogation.

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The appropriate form of the auxiliary do is supplied whenever there is no auxiliary in the corresponding declarative sentence. We have noticed that verbs without auxiliaries can be inflected for tense, i.e., either the past tense or the marker for the present indicative tense, which shows up in the third person singular form only.

We walk.	He walked.
I walk.	He walks.
They walk.	

Under questioning, when the auxiliary do is supplied, do carries the tense markings rather than the main verb. Thus, the above set becomes:

Do we walk...?	Did we walk...?
Do I walk...?	Does he walk...?
Do they walk...?	

Negation is most frequently accomplished in English by attaching a negative element (not or its contraction n't) to the auxiliary of the verbphrase. This is carried over with the auxiliary in inversion for questions. As we have seen, not all sentences have auxiliary verbs, and one is required for both questioning and negation. If there is no auxiliary an appropriate form of do is supplied to carry the negation. Thus we find:

He can play soccer.	He can't play soccer.
Can he play soccer?	Can't he play soccer?
What can he play?	Why can't he play soccer?
He walks.	He doesn't walk.
Does he walk?	Doesn't he walk?

This seems rather a complex story, but can be summarized as follows: In almost all questions, the auxiliary component and the noun-phrase subject are interchanged, or inverted. If there is no auxiliary, the appropriate form of do is supplied which carries the tense markings with it in inversion. For sentence negation, the negative element not or n't is connected with the auxiliary and moves with it before the nounphrase.

C. Wh Word Placement - Object Questions

Contrast the following:

CHAGALL MADE STAINED GLASS WINDOWS FOR THE CITY OF JERUSALEM.
WHAT DID CHAGALL MAKE FOR THE CITY OF JERUSALEM?

First of all, something is missing from the array of words which comprise the original sentence, and that is the object of the verb: stained glass windows. Instead we find

an interrogative word WHAT at the beginning of the question. If you think about it, it is clear that it is the object nounphrase which is being questioned, and to which the what refers. Rearrange the string in another way which means the same thing, and the operation involved may become clearer:

CHAGALL MADE WHAT FOR THE CITY OF JERUSALEM?

The question word what refers to the object position of the sentence, and is moved to the beginning of the string to produce the question, WHAT DID CHAGALL MAKE FOR THE CITY OF JERUSALEM? Notice that the auxiliary inversion operation has already applied.

D. Wh Word Placement - Subject Questions

Consider in addition to the above two utterances:

WHO MADE STAINED GLASS WINDOWS FOR THE CITY OF JERUSALEM?

In this case, the subject has been replaced by the wh word, and no movement is necessary since the positon replaced is first in the sentence. In addition, these questions differ from object questions in that no inversion takes place, and do is not supplied when no auxiliary is present in the sentence.

The main operation we have suggested here is: Any nounphrase position in a simple sentence can be questioned. If an object nounphrase is questioned, the element that is being questioned is replaced by a wh interrogative word and is moved to the front of the question, after the operation of auxiliary inversion. If a subject nounphrase is questioned the wh word replaces the subject position and the word order remains the same.

To emphasize the point, we can return to nonsense syllables. Suppose we use the same nounphrase in both positions:

WHAT CAN WIBBLE THE BIK?
WHAT CAN THE BIK WIBBLE?

We still can know that in the first case, the bik is the object nounphrase and it is the subject which is being questioned; and in the second case, the bik is the subject nounphrase and the object is being questioned.

E. Tag Questions

Tag questions like:

He can go, can't he?
She didn't say, did she?

are formed in a regular fashion. After a comma which is marked by a continuing pitch level in speech, the auxiliary of the sentence is repeated (with a negative element if the sentence is positive, without negation if the sentence is negative), and the subject nounphrase is pronominalized. The tag carries a rising intonation contour like the question form. If there is no auxiliary, do is supplied and carries the tense attachments as in other questions

He goes fast, doesn't he?
The girl didn't go home yet, did she?

We have discussed several operations which seem to be involved with interrogation in English in some intimate way. These may seem to be fine points and a great deal of detail, but if one considers that the appropriate use of these few operations will enable one to transform an infinite set of sentences into an infinite set of questions, the power of this set of tools becomes more obvious. The fact that I could give you any simple sentence in the English language and you could construct a yes/no or wh interrogative from it (presumably by using these operations) means that it is a capacity about language to be considered when we discuss language acquisition. The child by the age of four or so can accomplish the same feat. The stages by which he arrives at this ability are the concern of the last part of this paper.

A Note on Historical Development of Interrogatives

There has been considerable shift in the use of the auxiliary system from old English to modern English, as this set of questions taken from the plays of Shakespeare will reveal:

Yes/No Questions

Shrug'st thou, malice?
Heard you this, Gonzalo?
Seest thou here?
Well, then, go you into hell?
Look you for any other issue?
See you where Benedict hath hid himself?
Sits the wind in that corner?

Wh Word Questions

What says he to your daughter?
Which way looks he?
How came you to this?
How know you he loves her?
Why speaks my father so ungently?
How say you?
Where had he wine?
Wherefore weep you?

In modern English, the auxiliary system bears a heavy grammatical burden, in that four universal grammatical functions are intimately connected with the auxiliary verbs (Twaddell, 1963). We are concerned here with three of these: the auxiliary carries the n't of negation it is inverted with the subject nounphrase in interrogation; it is involved with the formation of tag questions. In all these cases, modern English requires the insertion of an auxiliary (do) wherever one is not present in the original sentence. This last is fairly recent development in English. At the time when Shakespeare was writing his plays, it was an optional rule of the grammar. One frequently found questions without an auxiliary, and in these cases, the main verb was inverted with the subject nounphrase to signal interrogatio

It is the absence of do which gives the special character to the set of questions quoted above, and the fact that the main verb has been inverted with the subject instead. For example, Seest thou here? today becomes Do you see here? and What says he to your daughter? changes to What does he say to your daughter?

It is interesting to notice that in the three children we studied there was no tendency to repeat this historical development, and inversion in questions does not appear until after the auxiliary system develops in the children's speech.

Summary of Interrogatives in English

Rising Intonation Contour: The normal speaking sentence pitch pattern is shaped like this: A question intonation pitch pattern rises somewhere toward the end of the utterance and stays up, like this: This intonation contour converts any sentence into a question, occurs with tag questions, and with yes/no questions (but not wh word questions). Thus: The boy went out? Did the boy go out? The boy went out, didn't he?

Auxiliary Inversion and Negation: In almost all questions, the auxiliary component and the nounphrase subject are interchanged (the exception: subject nounphrase questions). This operation alone converts a string into a questionlike utterance, even without rising intonation. The yes/no questions have additionally operation I, and the wh word questions have an interrogative word as well as auxiliary inversion.

The negative element (n't or not) is connected to the auxiliary and moves with it.

The boy can go there.	Can the boy go there? Where can the boy go? Why can't the boy go there?

Wh Word Placement: An interrogative word (what, who, why, where, when, etc.) may be considered as replacing some missing element in the sentence, for example, the subject or object nounphrase. This interrogative word marker can then be thought of as moving to the front of the question, after operation has applied.

John hit what?	What did John hit?
The boy can play with what?	What can the boy play with?

Subject questions simply replace the subject position nounphrase with the wh interrogative word, and no auxiliary need be supplied.

Formation of Tag Questions: Tag questions are formed by repeating the auxiliary of the sentence (or adding do if there is none); adding a negative to the auxiliary if the main sentence is non-negative, but leaving the negation off if the main sentence is negative; and a pronoun or pronominalized subject.

The flowers can stay there, can + n't - they - ?
The oranges aren't in the bowl, are - they - ?

Description of Data[1]

For more than four years, our research group (Prof. Roger Brown and his associates[2]) has been studying language acquisition. We have as data for this research a development study of the language of three children. We collected two hours of speech every two weeks in a natural setting; that is, recordings of conversations between mother and child in the home. We have supplemented this data by performing small experiments to begin investigation of the child's grammatical comprehension and competence.

The children we have been studying are a special sample; Adam and Eve were chosen because they produced a high rate of speech that was largely intelligible. The fathers of both children were graduate students at Harvard, and the children were only children when the study began. We have added a third subject to our small sample whom we are calling Sarah. She is the daughter of parents who have not completed high school, and her language environment contrasts with that of the other two. We looked for a situation in which the mother did not expand the child's speech as often as did the mothers of Adam and Eve.

Obviously the sample seems exceedingly small for generalizations about the development of language in children. Comparison of our data with data from other research centers[3] and with studies made by Brown and Fraser (1964) on a dozen children show that developmental milestones seem to be remarkably constant across children, and therefore the intensive study of a small sample seems highly appropriate.

With these three children, each child was followed by a different investigator; the families were totally unacquainted and independent of one another; each child heard a different set of sentences as "input"; and yet the language milestones as we shall see are constant.

The children were beginning to string words together in two- and three-word utterances when we began the study. Their speech was characterized by a lack of inflections and an absence of functors and was largely telegraphic, as described in an earlier paper (Brown and Bellugi, 1964). When we began the study, Eve was 18 months old, Adam 26 months old, and Sarah 27 months old; however, all three were at approximately the same stage of language development.

Stages	Eve	Adam	Sarah
I	18	28	27
II	22	32	32
III	25	38	38

Table 1A. Ages in Months at First Sample Chosen for Inclusion in Study.

Stages	Eve	Adam	Sarah
I	1.8	2.0	1.8
II	2.9	2.5	2.3
III	3.6	3.6	3.4

Table 1B. Mean Utterance Length for all Utterances in Samples Combined to Make up Stages.

For each child, then, we have two to four sessions of the speech of the mother and the child per month as data. These sessions were tape recorded and later transcribed together with a written record made at the time of the recording which includes some aspects of the situation which relate to the meaning of the interchange. We have analyzed the mothers' speech as well as the children's so that we have some knowledge of the speech sample each child has heard and some basis for comparisons between mothers of mother-to-child speech.

In general, we have found that the frequency profiles of the mothers are very similar for sentence types. The correlations range from .65 to .90. We found that the correlations between two profiles on one mother taken in different weeks were as high. Sentence types seem to have a relatively stable frequency over numbers of samples in the speech of the mothers. One interpretation of these data is that there is a standard mother-to-child language when viewed in terms of sentence types.[4]

In order to describe stages in development, I have pooled the data of all three children to pick sample questions for discussion and analysis. In the appendix however, one can find the samples separated out for each child. I have used some rough indicators to pick comparative samples--the best general indicator of language development still seems to be mean utterance length. I picked two end points in terms of mean utterance length: the first stage is from the first month of the study for each child; the last is from the month in which the mean utterance length consistently went above 4.0 for each of the three children. Then I picked four points in between dividing the span of time covered into equal segments. This gave six samples for each child. Because this story is far too long for a conference report, I have pooled these into three stages combining two at a time, but I shall report on the data more fully elsewhere, and the data warrant further divisions than I have made here.

Stage 1.

The structure of the children's sentences at stage 1 has been described often in our past papers. The sentences average only two morphemes in length, and consist most often of unmarked nouns and verbs. Notably missing are inflections, auxiliaries, articles, determiner quantifiers, even most pronouns. There is very little structure to be described, but it is worth noting that even at this early stage, the child has means of expressing basic sentence functions, as declarative, negative, imperative, interrogative. The sentences include: Papa go. Baby up! No Mommy eat. Mommy read. No sit there. No a boy bed. etc.

There are interrogatives, with and without a wh word. These are some of the questions we want to describe:

Fraser water?
Mommy eggnog?
See hole?
I ride train?
Have some?
Sit chair?
No ear?

Who that?
Why?
Why not?
What's that?
What doing?
What cowboy doing?

Where Ann pencil?
Where Mama boot?
Where kitty?
Where my milk go?
Where horse go?

Structure of Questions: It seems that almost any utterance can be transformed into a question by changing the intonation pattern to 2-3-3. Since there is so little structure to these sentences, it is not possible to define any constraints on questions. There are none of the identifying characteristics of yes/no questions, since there are no auxiliaries, no subject-verb inversion, and relatively little tense marking.

The wh questions can be described as a list which includes only a few routines that vary little across the three children. The most common questions are some version of What's that? and Where Nounphrase (go)? and What (NP) doing? It is not even clear that there is always a structural distinction between wh and yes/no questions at this stage. One child has both Where boy go? and Boy go?

The only one of the operations which we have described for adult English which is present at this stage is the rising intonation contour that marks yes/no questions. It

seems that any utterance can be converted into a question by changing the intonation pattern.

S - Q

where Q is a rising intonation contour over the sentence.

There are a few negative questions. Negative at this stage is not in position to be connected with the auxiliary of a sentence and there are no auxiliaries. It is a marker which generally precedes a sentence and occasionally follows. The basic rule for negative at this stage is:

Neg - S

where Neg is no or not. Negative questions are formed by pronouncing this with a rising intonation contour:

Neg - S - Q

There are not tag questions, nothing like wh questions which question subject or object position, except for the few routines described. This stage can best be characterized as the stage when the child has a question marker (a rising intonation contour) and a few routine wh questions. Two of these routines act as frames for the noun or nounphrase of an utterance.

Where NP (go)?	What (NP) doing?
Where kitty?	What cowboy doing?
Where string?	What paper clip doing?
Where Ann pencil?	What doing?
Where Mama boot?	What you doing?
Where ball go?	
Where Adam go?	
Where Papa go?	
Where my milk go?	

Comprehension of Questions: Our data consists of recorded conversations between mother and child, and it is possible to gain some insight into the child's comprehension of grammatical constructions by examining his response to certain types of questions that the mother asks. An example would be the what-object questions. In order to give an appropriate response, we can presume that the child must understand that the object is being questioned; that the wh interrogative word refers to the object of the verb. If we take the set of what-object questions which the mother asks in the course of the samples of speech, we find that generally the child does not respond, or responds inappropriately.

For example:

Mother	Child
Well, what did you hit?	Hit.
What did you do?	Head.
What are you writing?	Arm.
What do you want me to do with his shoe?	Cromer shoe.
What are you doing?	No.

It seems clear, then, that at this stage the child is not producing questions that even superficially resemble what-object questions, and that he does not understand this construction when he hears it.

Stage 2.

There is considerable development in the structure of the sentence since stage 1. Notably, pronouns have developed, articles and modifiers are often present, some inflections (present progressive and plurals, irregular past forms), and the verbphrase may include a prepositional phrase or a preverb. There are still no auxiliaries, but two negative preverb forms (don't and can't) which are prior to development of an auxiliary system. There are no indefinite pronouns and no clauses or other signs of embedding in the grammar.

There are some minor developments in interrogatives. Some of the questions we want to consider are:

See my doggie?
Dat black too?
Mom pinch finger?
You want eat?
I hab it?

Where put him on a chair?
Where my mitten?
Where baby Sarah rattle?
Where this goes?
Where me sleep?

What getting?
What book name?
What happen me?
What in there?
What methink?

Who bought that?
Who is it?
Who brought him home?
Who making that noise?

Why?
Why you smiling?
Why you waking me up?
Why need them more?

Why not?
Why not he eat?
Why not me sleeping?
Why not...cracker can't talk?
Why not...me can't dance?

You can't fix it?
This can't write a flower?

Structure of Questions: Yes/no questions are signalled by questions intonation only, as in stage 1, for two of the three children. Since there are no auxiliaries, there is no auxiliary inversion. But there is no subject inversion either, as in the Old English form. One of the three children has an additional rule for forming yes/no questions, which is worth noting since it is so clearly a precursor of the well-formed yes/no question which will appear in the next stage. Adam produces numerous examples in each sample of these:

D'you want it's turn?
D'you want me...should be careful?
D'you want me tie that?
D'you want me get it?
D'you want me have birthday?
D'you want me drink it?
D(you) want me that go?

The usual form is: D'you want (pro) VP? and after several weeks the D'you want has become fused into a single word pronunciation. This seems clearly a question marker for yes/no questions. It operates almost like the pivot plus open class constructions of the very earliest stage. This question marker (D'you want- pro) operates as a yes/no question introducer, and can be associated with Adam's range of verbphrases (and an occasional sentence: D'you want me that go?). We will see that this invariant form has dropped out in the next stage when the auxiliary system is available and yes/no questions are well-formed.

The yes/no questions with a negative preverb are formed by the operation of the question intonation only. One finds You can't fix it? rather than the well-formed Can't you fix it? There are no tag questions at this stage.

In the wh questions, all wh interrogative words are in initial position; the auxiliaries are missing, and there is no subject-verb inversion. There is very little evidence for replacement of a missing element or constituent of a sentence by the wh word and the preposing of this wh interrogative at the front of the question (operation C of the adult rules) which we will find in the next stage. Instead it seems simplest to consider the wh interrogative word as a question introducer which does not yet replace anything in the underlying form. Questions like the following make it difficult to distinguish subject and object questions:

Who bought that?
What getting?
Why need them more?
Where put him on a chair?

and suggest the analysis of the wh question at this stage as an interrogative wh word followed by VP or S.

Further evidence in this direction is the set of Why not questions. We find Why not he eat? and Why not...me can't dance? in Adam's speech. The simplest description of this set is

Why not - S

where S may contain a negative preverb. At no place in the children's grammar in this stage do we find multiple negation, and this form also drops out by the next stage.

The sequences we have suggested for questions, then, and the operations which seem to be involved at stage 2 are:

A. Any sentence can be converted into a yes/no question by the application of Q, where Q is question intonation.

S - Q

One of the three children has the additional yes/no question marker:

D'you want - (pro) - VP - Q

B. There is no evidence yet for auxiliary placement and inversion. We find that sentences can have a negative preverb which is carried over into the question form but does not function as an auxiliary. Adam's invariant formula (D'you want) is not an auxiliary operation. There is no verb subject inversion.

S - Q

where S can have a negative preverb, NP - $\left\{\begin{matrix}\text{can't}\\ \text{don't}\end{matrix}\right\}$ - VP.

C. The wh interrogative word in this stage seems to function largely as a question introducer at the beginning of the question, rather than a replacement for a missing constituent in the sentence which has been moved to the front of the question. The evidence is not clear on this point, but is insufficient to credit the child with this operation, while it clearly is effective in the stage which follows this.

Wh - S

The following restrictions are loosely suggested for the distribution of S:

Who - VP
Why - S
Why not - S (where S may contain negative preverb)
Where - S
What - S

One other point that requires notice is that the first person singular reference in these questions is often pronounced me (or my) instead of I. This also drops out by the next stage.

D. There are no tag questions yet. One sometimes finds You did it, huh? or all right? but no You did it, didn't you?

Comprehension of Questions: We find by stage 2 that there are appropriate answers to most of the common questions. Looking specifically at the child's answers to what object questions we find a change since stage 1 when the child either did not respond or gave an inappropriate response. At this stage the balance has shifted, and all three children are giving largely appropriate answers to what object questions. The responses reflect that the child understands that the object of a verb or preposition is being questioned.

Mother	Child
What d'you hear?	Hear a duck.
What do you need?	Need some chocolate.
What else did you see?	See bridge.
What d'you have?	Have sugar.
Who do you love?	Mommy, you. I love fishie too.

There seems evidence of comprehension of an operation involved in constructing questions, but little evidence that the child uses this operation in constructing his own questions until the next stage.

Stage 3.

Between the last stage and this there is an impressive and sweeping set of developments in the children's grammar. For one thing, the auxiliary system has by stage 3 appeared in full flower in the children's speech. One finds almost at the same time auxiliary verbs appearing in declarative sentences, in negation, in yes/no questions, and sometimes in wh questions, although often in non-inverted form. The only preparatory indicators in the

previous stage were one child's D'you want (pro) question marker, and the placement of the negative preverbs don't and can't between subject and verb in all three children.

In addition we find the full array of noun and verb inflections appearing, including the third person singular present indicative, and the regular past. We find also that the sentences are no longer limited to simple English sentences. There has been some development in complexity, and we find clauses and other embeddings present for the first time: You have two things that turn around. I told you I know how to put the train together. I gon' get my chopper for chopping down cows and trees. They don't turn when I get on the floor. Let's go upstairs and take it from him because it's mine.

These and other changes in the grammar are clearly mirrored in the interrogative system, which is strikingly different from stage 2. Consider the following questions:

Does the kitty stands up?
Does lions walk?
Is Mommy talking to...Robin's grandmother?
Did I saw (that) in my book?
Oh, did I caught it?
Are you going to make it with me?
Do I look like a little baby?
Will you help me?
Can I have a piece of paper?

Where small trailer he should pull?
Where the other Joe will drive?
Where I should put it when I make it up?
Where's his other eye?
Where my spoon goed?

What I did yesterday?
What he can ride in?
What you had?
What you writing about?
What did you doed?
What are you doing to read for me, Fraser?
Sue, what you have in you mouth?

What lives in that house, Mommy?
Who took them all down?
Who took this off?
Who lost it?

Why the Christmas tree going?
Why he don't know how to pretend?
Why the kitty can't stand up?
Why Paul caught it?

Which way they should go?

How he can be a doctor?
How they can't talk?
How I push it back?
How that opened?

Can't it be a bigger truck?
Can't you work this thing?
Can't you get it?

Structure of Questions:

A. We find the question intonation operating over the yes/no questions as in previous stages, but now it involves the auxiliary system as well.

B. For the first time in the developmental data we have investigated, the auxiliary system is present and functioning in full. Auxiliary verbs have appeared in the children's declarative sentences as well as in negation and questions. The auxiliary verb is appropriately placed in declarative sentences, and the negative element n't is added for negation. Now almost all yes/no questions have an auxiliary (or some form of do) and the auxiliary and nounphrase are inverted. Notice the delicate tuning and agreements involved i

Is Mommy talking...	Do you get...
Did I hit...	Can I have...
Do you take...	Can't you work...
Will you read...	Are you tired...
Am I silly?	May I whistle...
Are we talking...	Did you drink...
Can we be...	Is Paul gonto be...
Will we have...	Is Fraser having...

And notice the following overextensions which we will consider:

Did I caught it?
Did I saw (that) in my book?
Did I lost one?
Did you broke that part?

Does the car carrier carries that?
Does the kitty stands up?

Does lions walk?
Does turtles crawl?

Some complications arise in tense marking when the dummy auxiliary do is supplied, but the operation of inversion of nounphrase subject and auxiliary verb seems clear. The form for a yes/no question, then, is:

Aux - NP - VP - Q

and the Aux component can have an optional negative attachment:

Aux + n't - NP - VP - Q

The auxiliary story with respect to the wh questions is different. When the auxiliaries are present (modals and be) they are often not inverted:

What the words are doing?
What he can ride in?
What I can put them in?
Where small trailer he should pull?
Where the man's truck should go?
Where I should put it when I make it up?
Why the kitty can't stand up?
Why he don't know how to pretend?

that is:

Wh - NP - Aux + (n't) - VP.

And if there is no auxiliary in the sentence, it is frequently not supplied, leaving the tense markers on the verb, and giving forms like:

What we saw?
What you took out?
What I did yesterday?
What you had?
How you opened it?
Where my spoon goed?
Where she went?
Why you caught it?

or:

Wh - NP - VP

The auxiliary form of be is also optional at this stage in wh questions:

What he writing?
What you writing about?
What Paul trying to see?
Where he gonna sit?
Why the Christmas tree going?

We have said that auxiliary inversion takes place in yes/no questions, and that the modal auxiliaries appear in wh questions, but generally are uninverted. At this stage, the children seem to place the auxiliaries appropriately for almost all questions, but invert them with the nounphrase only in yes/no questions. Note that do appears in yes/no questions, but seldom in wh questions.

There are a few negative yes/no questions, which are inverted, and a few negative wh questions, which are not, paralleling the above findings:

Can't it be a bigger truck? Why the kitty can't stand up?

C. At this stage there is ample evidence for considering the interrogative word as a replacement for some missing element in the sentence (subject or object nounphrase) which is moved to the front of the set of elements to form a question. We have seen that in the previous stage, the children responded correctly to what object questions, but did not construct them productively. Wh subject and object questions are now differentiated.

Notice that the string of words without the wh word is incomplete. It is no longer describable as S, but as NP - Aux - VP with some object NP missing from the VP. These cannot be considered as full sentences:

We saw...
You book out...
He can ride in...
You writing about...

There is another set of questions, the who questions, which have a nounphrase missing from the subject position in the sentence, if we subtract the interrogative word:

...lives in that house.
...took them all down.
...took this off.
...lost it.

D. There are no tag questions as yet. These appear in a later stage of the children's grammar.

Comprehension of Questions: The children understood and responded to what object questions in stage 2 already. In this data we find responses to more complex what object questions appropriate.

Mother	Child
What d'you need a rifle for?	I wanna shoot.
Then what will you do for milk?	I gonna buy some more cows.
What d'you think we should do?	I know what I should do; play with some more toys.

Summary of Stages of Interrogation

Stage 1

S	→	(Neg) - N (V) - (N)	Neg: no or not
Yes/No	→	S - Q	Q is rising intonation
Wh	→	Wh - (NP)	A list of routines. NP can vary in a few routines like, Where NP (going)?

Stage 2

S	→	NP - (neg prev) - VP	Neg preverb: don't or can't
Yes/No	→	S - Q	Q is rising intonation
Wh	→	Wh - S	

Stage 3

S	→	NP - Aux (+n't) - VP	Aux: modals, do, be
Yes/No	→	Aux - NP - VP - Q	Q is rising intonation, Aux has been moved.
Wh_o	→	{ Wh - NP - VP ; Wh - S }	Object Q's. Sometimes do missing, and object NP is missing; aux not moved
Wh_s	→	Wh - VP	Subject Q's

We have looked closely at the set of operations involved in constructing English interrogatives, and examined three periods in the child's progression toward full mastery of these rules.

First, we have found that the milestones toward acquisition of language are constant across the three children. The three begin the process by stringing small sets of unmarked nouns and verbs, but develop similar ways of expressing basic sentence functions, like negative (neg + S) and interrogative (S + rising intonation, a few routine wh questions).

By the third stage of our investigation, the auxiliary verb system has come into play in full and across the board. That is, with all three children, auxiliaries were notably absent from speech in the early stages (say, when the mean morpheme per utterance length was below 3.4), and then within a relatively short period of time, auxiliaries abound in declarative sentences, negative sentences, yes/no interrogatives. Complex sentences or embedded sentences appear at this stage in the three children.

Second, we found that the children may have alternative pathways to the same goal that differ only at superficial levels. For example, in stage 2, Sarah and Eve both formed yes/no questions by rising intonation contour only. Adam formed yes/no questions in the same way, but had additionally a yes/no question marker, like a pivot construction, which consisted of an invariant form (D'you want [pronoun]), and he restated his verbphrases with that. On the surface, one might consider that Adam has developed the use of an auxiliary, the dummy do, and that this is inverted with the nounphrase to form quotations. But on consideration of all the evidence, this is a single invariant form (no other auxiliaries, no other inversions, no other forms of do even) and can best be described as an additional question marker, rather than an operation on sentences. Eve and Sarah use question intonation only to mark yes/no questions; Adam uses that plus his question marker.

Third, we have begun to look at the development of transformational operations, in children's language. It is not clear what the antecedents of transformational operations are, in stages 1 and 2. But the evidence is good for considering that the child performs certain operations on strings that are definable as transformational operations by stage 3. We find strong evidence for auxiliary inversion for interrogation, and for the do transformation, and good evidence for the replacement of some constituent in a string by a wh element, and the movement of that to the beginning of the question.

If we look closely at the data in stage 3, we find that the children can perform these three operations, but there seems to be a limit on the number of operations on one string at this period. That is, we find in yes/no questions, auxiliary inversion and the do transformation. At the same time, in wh questions, we find an absence of do and no

inversion even when the auxiliary is present. There is clearly not an inability to perform each of these operations, but there may be some limit on the number which a child can do at one time. Typically, we find at this stage, Can I go out? Why he can go there? and What you took out? A good deal more work will have to be done before there is solid evidence for this notion, but the productions of the three children we have studied at this stage seem highly suggestive.

Appendix

Sample Questions from each of Three Children for Three Stages

Stage 1.

SARAH	EVE	ADAM
Where kitty?	Why?	What that?
Where string?	What doing, Mommy?	Who that?
Where?	Where Papa go?	What happen?
Where go?	Where Ann pencil?	What train?
(What) (th)at?	Where Mama boot?	Where ball go?
		Where Dale go?
Doggie gone?	More?	What cowboy doing?
Gone?	Mommy?	What that paper clip doing?
See hole?	Papa get Anna pencil?	What you doing no?
Baby cry?	Tinker-toy doing there?	Where boot?
Kitty gone?	That?	Why not?
Boy?	Fraser water?	What dat needle?
My horsie 'nere?	Taste it?	
I throw 'way?	Kathy letter?	Sit chair?
No ear?	Anna table?	No more milk?
		Cromer, have some?
		Ball go innere?
		Mommy throw 'way?

Stage 2.

SARAH	EVE	ADAM
Where Donna?	Where Fraser elbow?	Where Mommy?
Where my mitten?	Where you coffee?	Where my milk go?
Where crayons?	Where Sarah going?	Where dis goes?
Where you go?	Where baby Sarah rattle?	Where other hammer go?
Where put him on a chair?		Where me sleep?
	Why?	Where you put it?
Who got my baby?	Why not?	
Who is it?		Who dat making noise?
Who rip dat?	What doing, Mama?	Who brought dis?
Who bought dat?	What that?	Who make dat?
Who milk is dat?	What Fraser you do?	
Who done this?	What in there?	Why not?
Why need them more?	What the dollie have?	Why me say Shadow Gay all time?
	What Mom name?	
What(s) that?		Why me go?
What color dis?		Why me going?
What's that on him mouth?		Why you...waking me up?
		Why it's all gone?
		Why me get some chocolate?
You want 'nere?	Fraser, like more?	Why not me sleeping?
See my doggie?	I hab it?	Why not...cracker can't talk?
Dat black too?	Let me eat it?	Why not...me can't dance?
I had dinner?	Mom, Mom pinch finger?	Why not me break dat one?
You want bobby pins?	Mom little teeth?	
You ride once more?	These are my mitten?	What me think?
Mommy, you want eat?	You gonna watch me eat my lunch?	What you looking?
Rub it like dis?		What you doing, Mommy?
It hurt?	My tapioca cool?	What happen me?
He sit down?	Sue making more coffee for Fraser?	What book name?
		What getting?
		What dose children doing?
		Cromer want some...grapefruit?
		Do like grapefruit?
		Do want more coffee please?
		Do want me dat go?
		D'you want it's turn?
		D'you want me...should be careful?
		D'you want me tie that?
		D'you want me get it?
		Do want me drink it?
		D'you want me have birthday?
		D'you want drink it?
		Do want he walk like dis?

Stage 3.

SARAH

Where he gonna sit?
Where's my other one?
Where is he now?
Where's his other eye?

Who lost it?
Who is it?

Why the Christmas tree going?
Why you...get to go down the stairs?
Why not?

Which one you want?

How you open it?
How you get them down?
How that opened?
How come you got lipstick on?
How many monkeys?
How you get them down?
What you had?
What my jingle bells doing up there?
What he writing?
What you writing about?

Do...you get two ice creams?
Can I have a piece of paper?
See my new bathrobe?
Do you want name?
Can we go up there?
Uh...will we have one?
Will I break it?
These for baby toys?
You got something in your mouth?
Can I do it?
Did you throw it away?
Can't you work this thing?
Will you help me?
Did I lost one?
Do I look like a little baby?
Is this pan cakes?
Can't you get it?
Is it on right?
You hear someping in here?
Are you going to make it with me?
Are you tired?

EVE

Where is a lady going?
Where Fraser and Cromer?
Where big round cook?
Where Papa go?
Where my spoon goed?

When Cromer and Fraser go home?

How I get in, silly?
How I push it back?

What are you going to have?
What are you going to read for me, Fraser?
What (the) words are doing?
And what did you do there?
And what did you does?
What did you doed?
What you having?
What me doing to you?
What me fold?
What you have on you nose...what you was having on you nose?
Sue, what you have in you mouth?

Can I have tapioca?
And you going down with me?
This can't write a flower?
May I whistle?
You have glasses?
Is that some noodles?
Is Fraser having coffee?
Did you drink all you coffee?
You can put these here?
Did you make them?
Do you have pockets in there?
You can put these here?

Stage 3.

ADAM

Where dis goes?
Where she went?
Mommy, where dis want to go?
Where dere's a heel?
Where small trailer he should pull?
Where the man's truck should go?
Where the other Joe will drive?
Where I should put it when I make it up?
Where we went?

Who took them all down?
Who took this off?

Why not...they don't got some teeth?
Why Paul jumping for joy?
Why she standing on (her) hand?
Why he don't know how to pretend?
Why the kitty can't stand up?
Why you caught it?
Why Paul say he going to knock all of my toys down?

Which way they should go?

How he can be a doctor?
How they can't talk?
How my car can't get in?
When this go on?

What it has in it?
What I did yesterday?
What he can ride in?
What we saw?
What Paul trying to see?
What we say oh?
What I can put them in?
What you took out?
What lives in that house, Mommy?
What are wood friends?

Is Mommy talking to...Robin's grandmother?
Are we talking 'bout dat boy burn de school down?
Can they should go down that Mass Avenue?
Did I hit it almost?
Oh, did I caught it?
Do you take it out?
Does it be around?
Did I saw (that) in my book?
Can we be men?
Can't it be a bigger truck?

Do you have games and lessons and stories and bags and anything?
Is Paul gonto be a nurse and I gonto be a doctor?
Will you read about the germs?
I am not... am I a doctor?
Does the car carrier carries that?
Does the kitty stands up?
Did you broke that part?
Ursula, does you tear these off?
Can I make him a tree after a finish this?
Did I see nice things?
Does lions walk?
Does turtles crawl?
Am I silly?
Can I make what I want?
Will you bowl with me?
Do you know what I think it is?

A Sample Grammar

Adapted from Katz and Postal (1964) and Ed Klima (personal communication).

Constituent Structure

S → Q + Nucleus

Nucleus → $\begin{Bmatrix} NP & VP \\ Adv & Theme \end{Bmatrix}$

Theme → NP VP

NP → Det. $\begin{Bmatrix} N \\ pro \end{Bmatrix}$

VP → Aux MV

MV → V NP

Aux → T (M)(Perf)(Prog) $\left|\begin{Bmatrix} V \\ \underline{have} \\ \underline{be}\ pred. \end{Bmatrix}\right.$

Wh can appear with any NP or Adv in S.
If one wh marker, have Q marker as well.

Transformations

T1. Move wh + X to left of phrase marker, if S includes Q.

T2. Invert Aux and NP_s if wh dominated by Adv.
Optionally invert Aux but not delete from original position.
Add do to first of unaffixed affix.

T3. Delete Adv where it dominates wh.

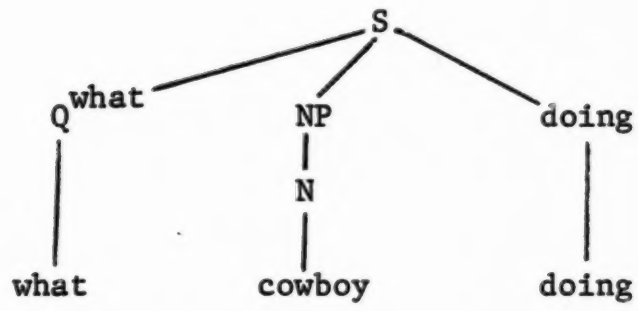
T4. Move Q to right where Q doesn't dominate wh.

T5. Delete Q unless final in sentence. If final, spell as 2 3 3 ‖ .

Stage 1.

Derivation of What cowboy doing?

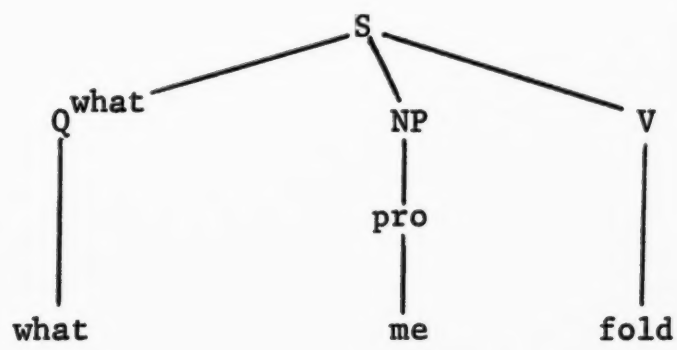
$S \rightarrow Q^{what} - NP - (doing)$



Stage 2.

Derivation of What me fold?

$S \rightarrow Q^{what} - NP - V$

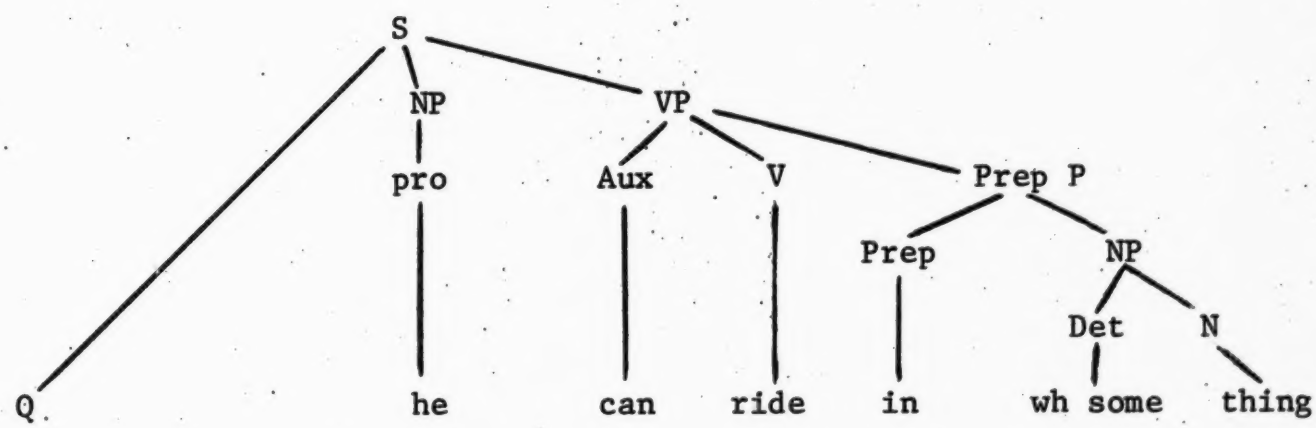


Pro, 1st per. sing. → me in env. wh_____

Stage 3.

Derivation of What he can ride in?

S → Q - NP - Aux - VP



Transformations

T1. Move wh some thing to left of marker.

T2. Does not apply: Auxiliary in ersion is optional rule with wh for children. Word boundary.

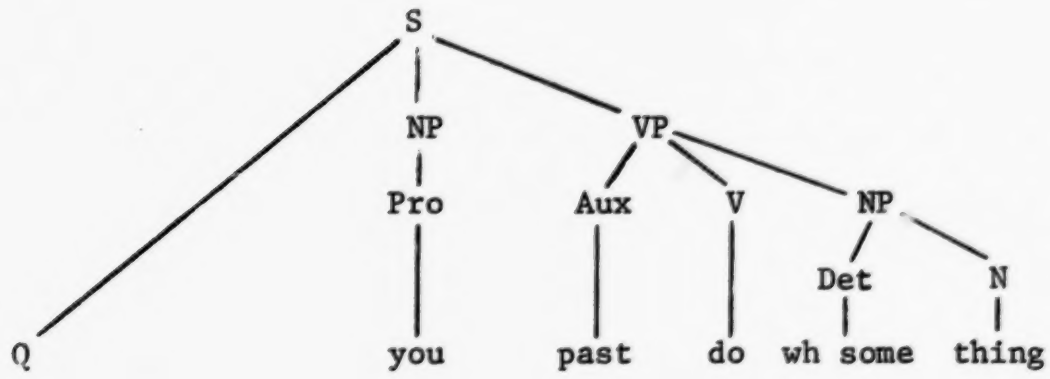
T5. Delete Q. Wh some thing → what.

(following Katz and Postal, 1964)

Stage 3.

Derivation of What did you doed?

S → Q - NP - Aux - VP



T1. Move wh some thing to left of marker

T2. Move auxiliary to left of NP, but do not delete from original position. (Child's rule). Word boundary and do application.

T5. Delete Q. Wh something → what.

(following Katz and Postal, 1964)

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Footnotes

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2. The group has included Jean Berko Gleason, Colin Fraser, David McNeill, Dan Slobin.

3. Susan Ervin and Wick Miller at the University of California, and Martin Braine at Walter Reed Army Institute of Research.

4. Taken from Roger Brown's study of language samples from the three mothers.

Symbols

(x)	Symbol in parens is optional
$\left\{ \begin{matrix} x \\ y \end{matrix} \right\}$	One of the symbols must be chosen
+	Symbols on either side are joined
$X \rightarrow Y$	X may be rewritten as Y